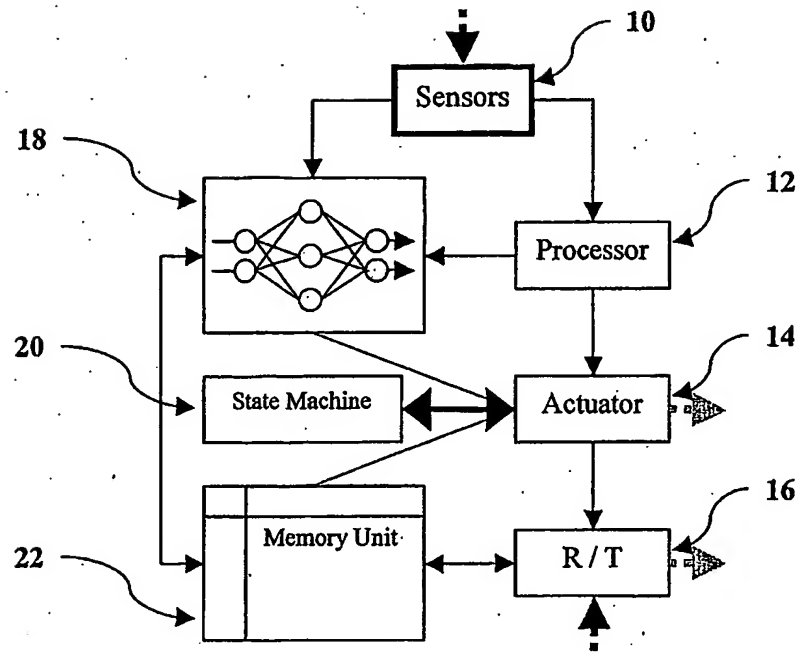Figure 1: Agent initialization and assignment

Figure 2: Agent Components

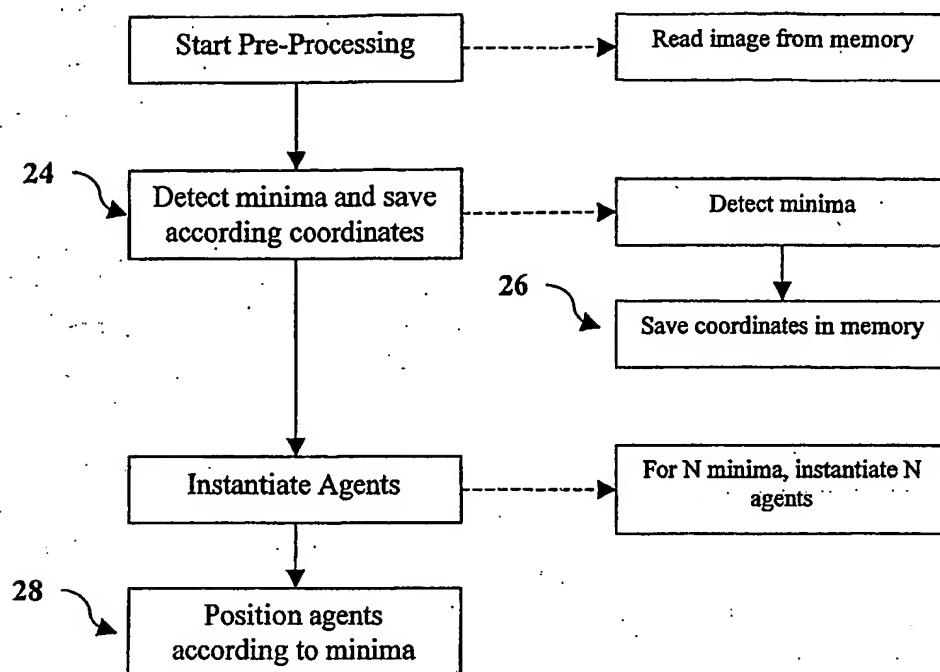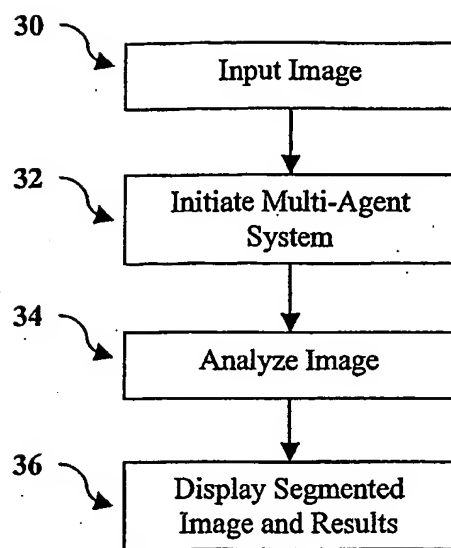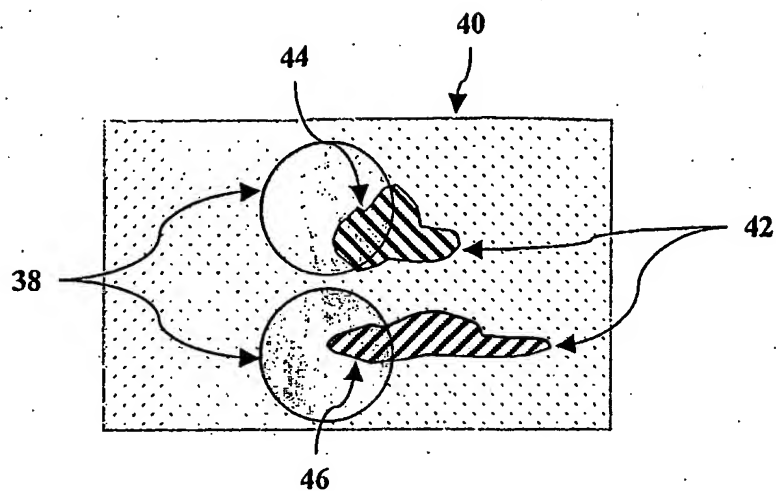SUBSTITUTE SHEET (RULE 26)

```
┌──────────────────────┐              ┌──────────────────────┐
│  Start Pre-Processing │ - - - - - ─► │ Read image from memory│
└──────────┬───────────┘              └──────────────────────┘
           │
           ▼
24  ┌──────────────────────┐          ┌──────────────────────┐
    │ Detect minima and save│ - - - -►│    Detect minima      │
    │ according coordinates │          └──────────┬───────────┘
    └──────────┬───────────┘                     │
               │                                  ▼
               │                  26  ┌──────────────────────┐
               │                      │Save coordinates in memory│
               │                      └──────────────────────┘
               ▼
    ┌──────────────────────┐          ┌──────────────────────┐
    │  Instantiate Agents   │ - - - -►│For N minima, instantiate N│
    └──────────┬───────────┘          │        agents         │
               │                      └──────────────────────┘
               ▼
28  ┌──────────────────────┐
    │    Position agents    │
    │  according to minima  │
    └──────────────────────┘
```

Figure 3: Example Agent assignment

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30 → Input Image

32 → Initiate Multi-Agent System

34 → Analyze Image

36 → Display Segmented Image and Results

Figure 4: Overall system operational flow

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Figure 5: Agent Sensors in portion of image

SUBSTITUTE SHEET (RULE 26)
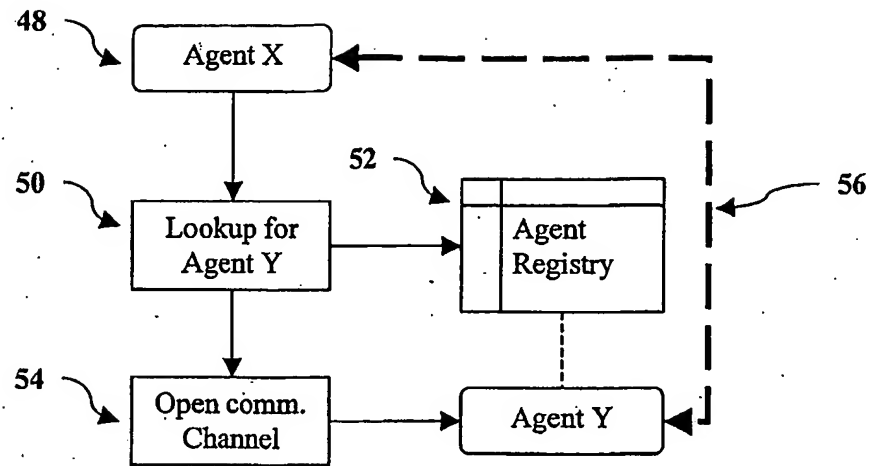
Figure 6: Agent communication

58

Level N

60

Level N -1
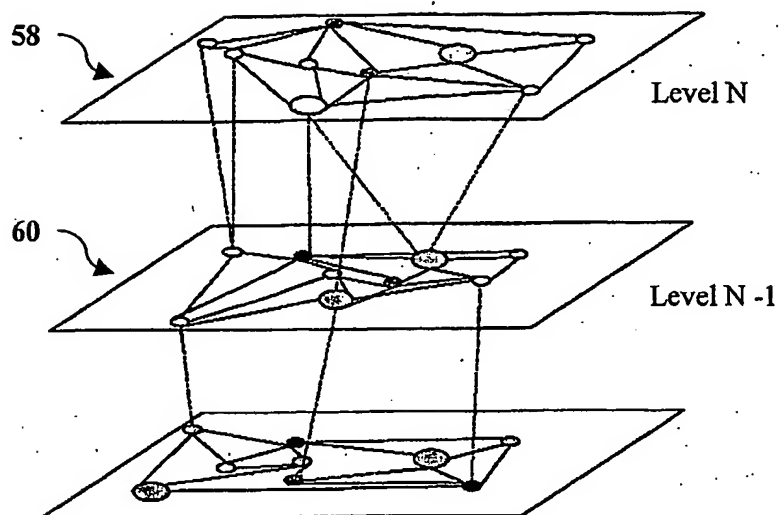
Figure 7: Multiscale Agent cooperation

SUBSTITUTE SHEET (RULE 26)
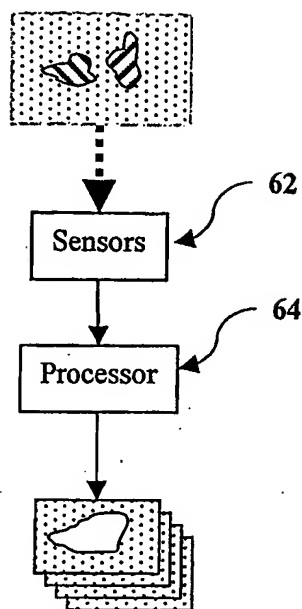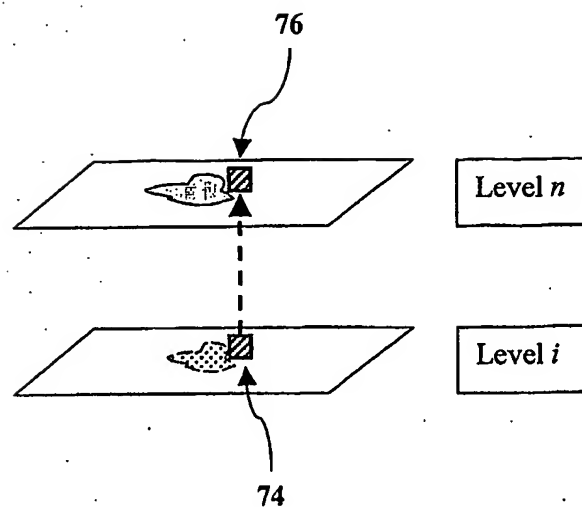
Figure 8: Multiscale Sensors

SUBSTITUTE SHEET (RULE 26)
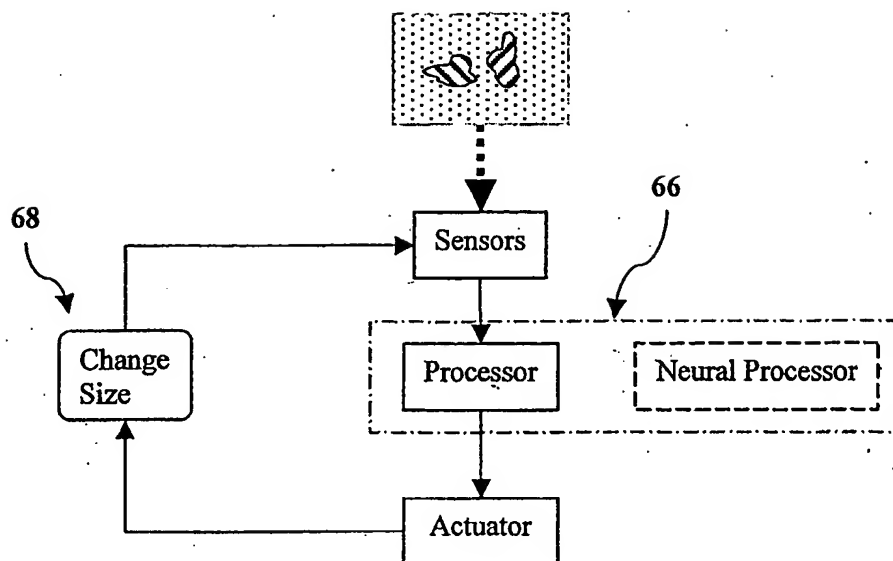
Figure 9 a: Multiresolution Sensing Flow chart
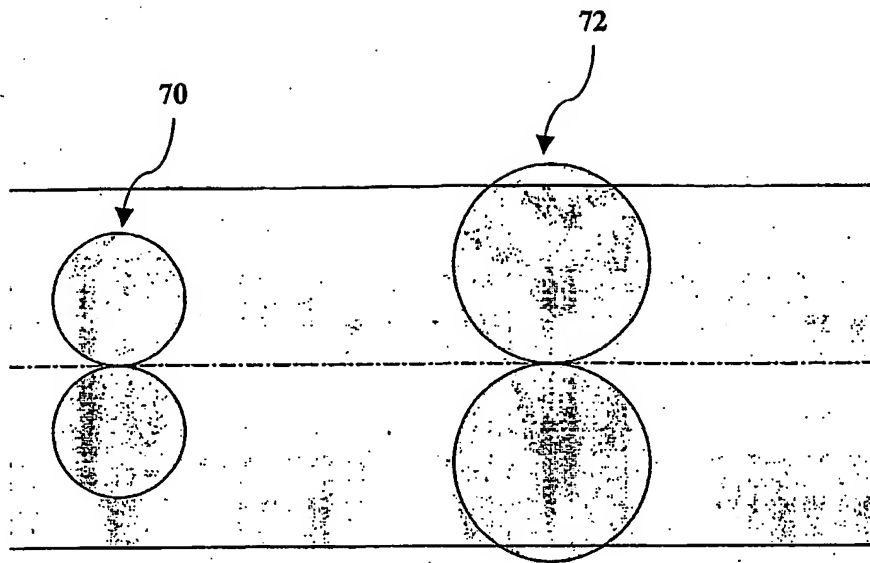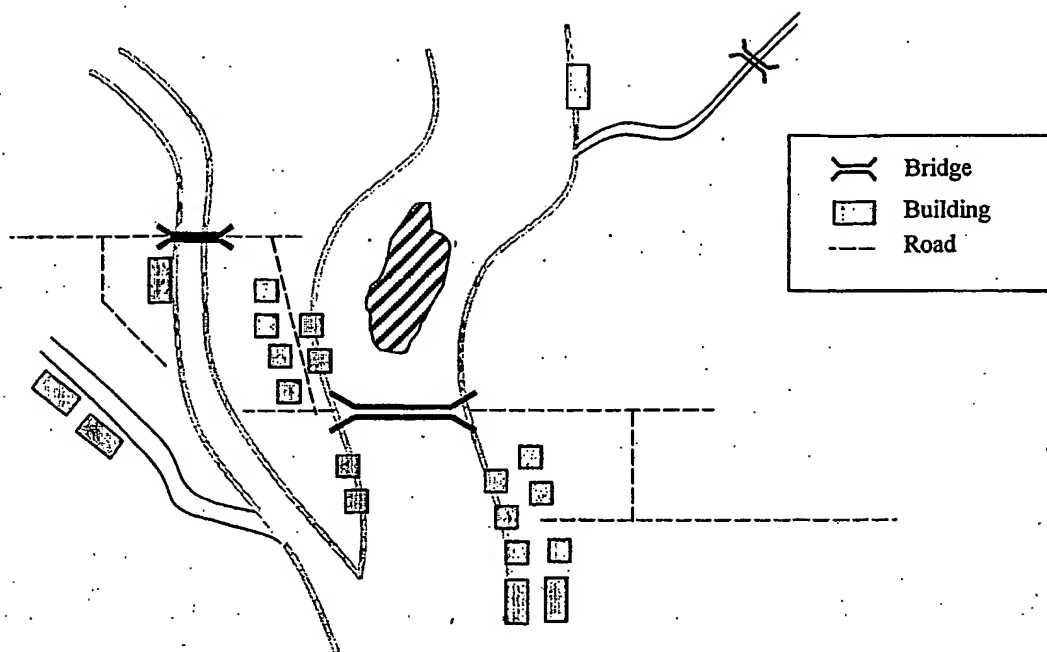
Figure 9b: Multiresolution Sensing Illustration

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Figure 10 a: Higher scale information gathering by single agent

```
          ┌──────────────────────────┐
78 ──→   │   Identify current image  │
          │        coordinate         │
          └──────────────────────────┘
                       │
                       ▼
          ┌──────────────────────────┐
80 ──→   │     Load scale n image    │
          └──────────────────────────┘
                       │
                       ▼
          ┌──────────────────────────┐
82 ──→   │    Set as current image   │
          └──────────────────────────┘
                       │
                       ▼
          ┌──────────────────────────┐
84 ──→   │          Analyze          │
          └──────────────────────────┘
                       │
                       ▼
          ┌──────────────────────────┐
86 ──→   │     Update and adapt      │
          └──────────────────────────┘
```
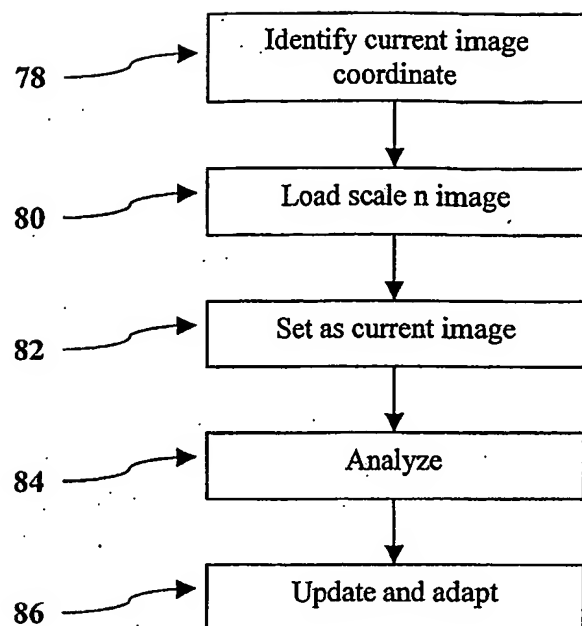
Figure 10 b: Higher scale information gathering by single agent

88 → Instantiate new agent

90 → Copy state and memory

92 → Position at higher scale

94 → Analyze

96 → Communicate knowledge
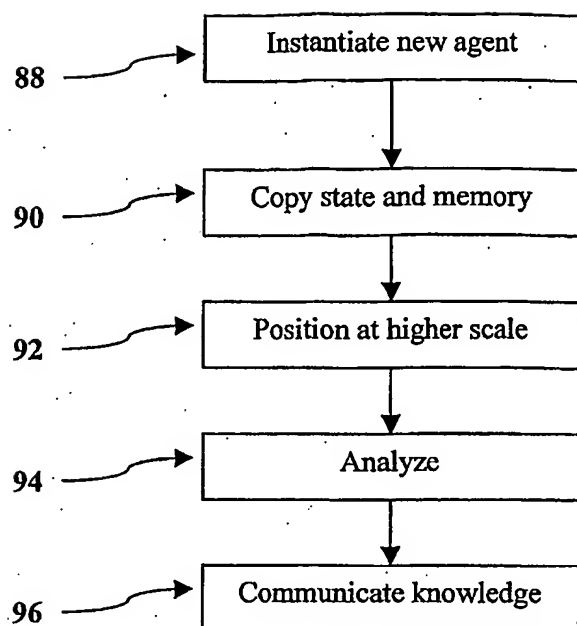
Figure 10 c: Higher scale information gathering by cloned agent

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Figure 11: Illustration of a satellite image landscape.

SUBSTITUTE SHEET (RULE 26)
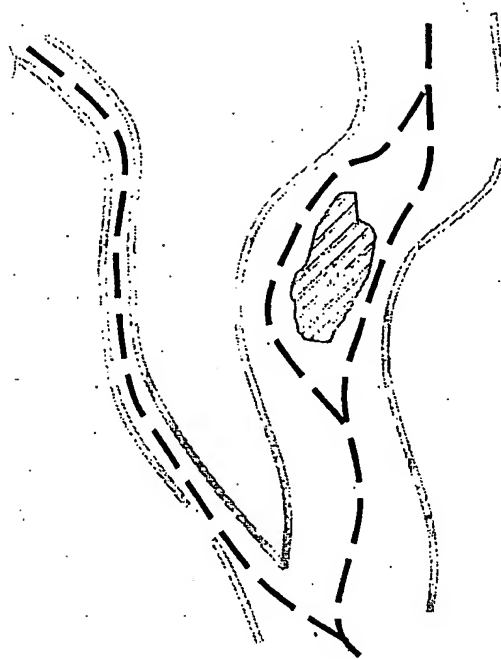
Figure 12 a: Extraction of main water regions and ridges

SUBSTITUTE SHEET (RULE 26)
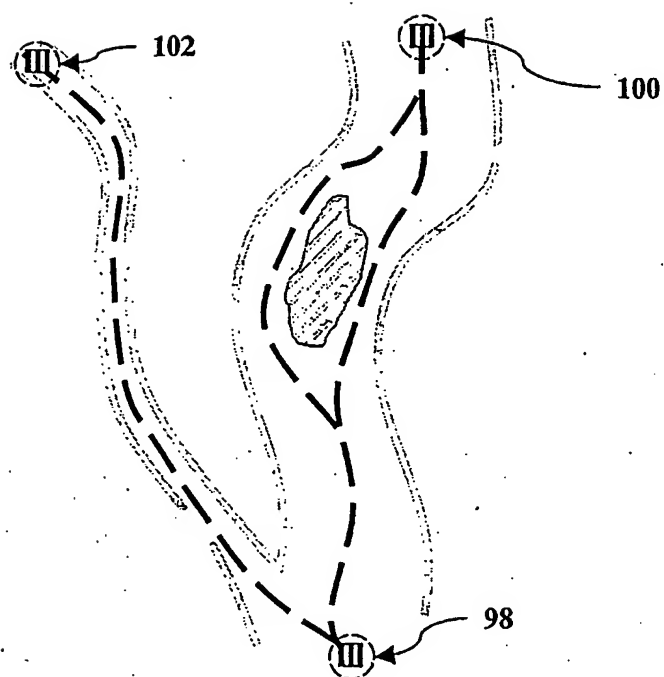
Figure 12 b: Agents initialization
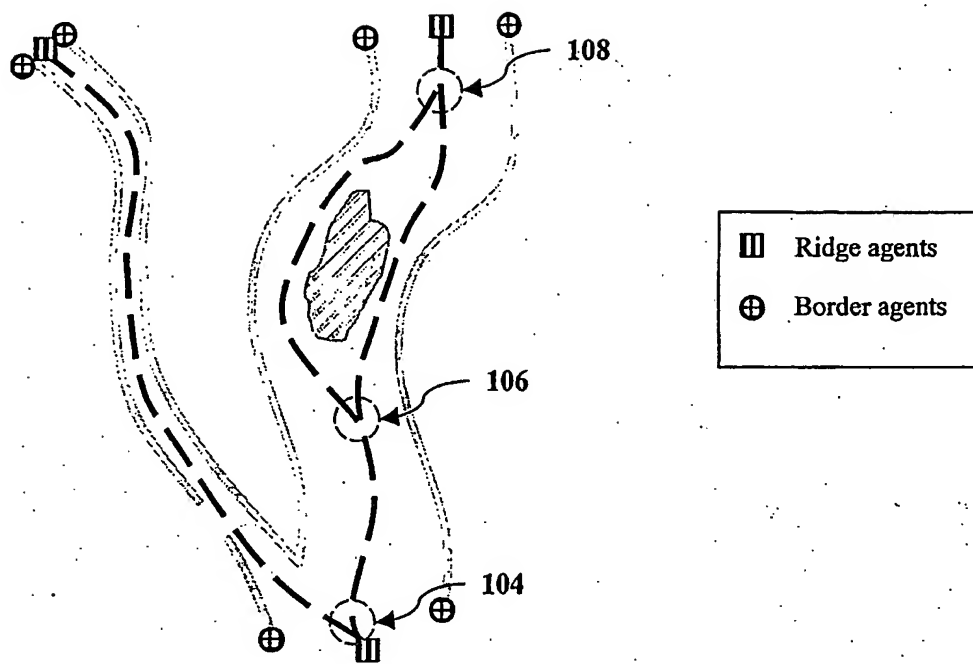
Figure 13: Border Agents init. and ridge agents path following

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110

112

| ⫫ | Ridge agents |
| ⊕ | Border agents |
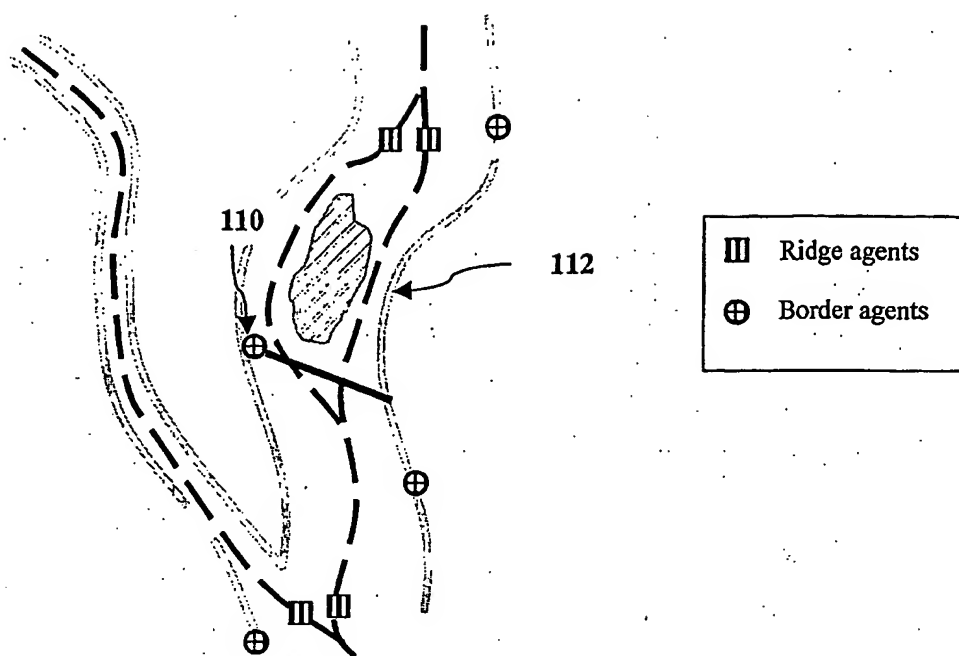
Figure 14 a: Bridge detection
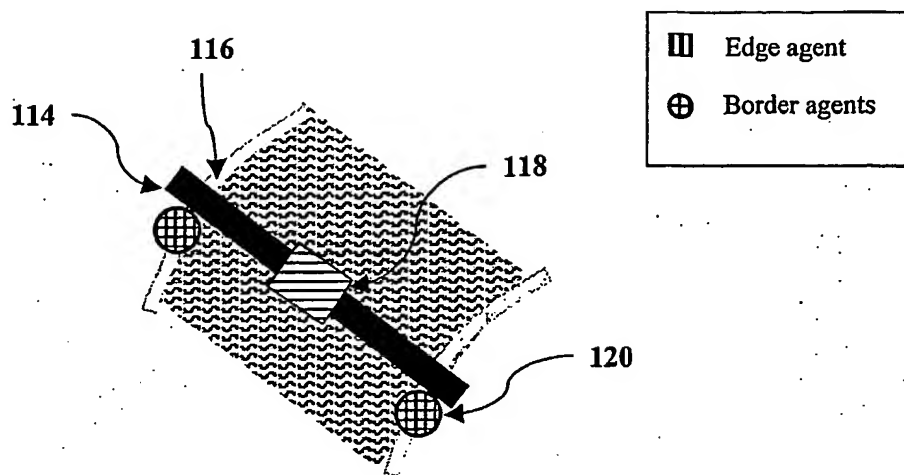
Figure 14 b: Discontinuity in border

SUBSTITUTE SHEET (RULE 26)
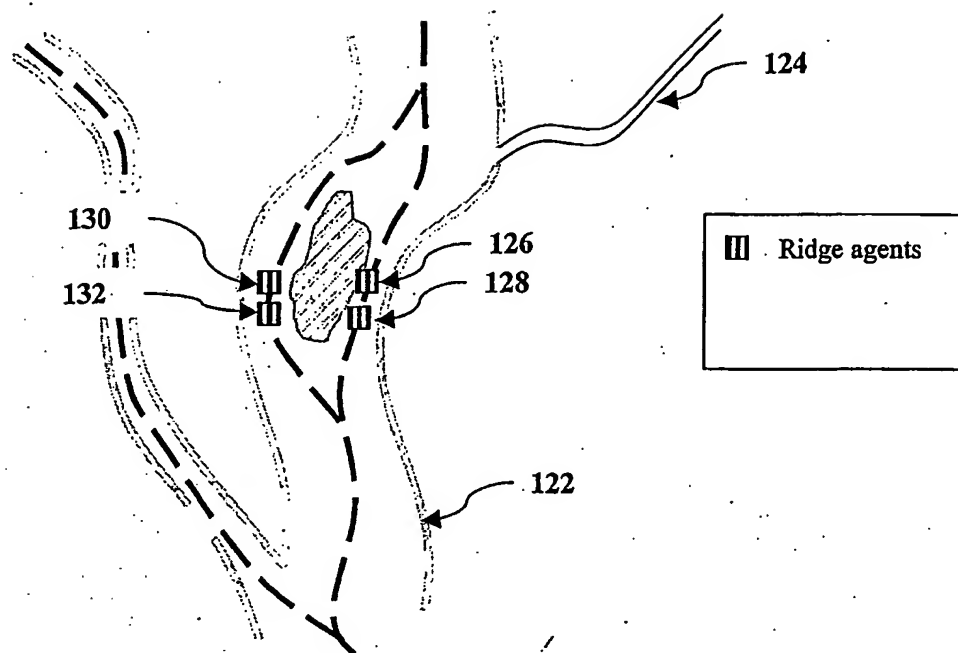
Figure 15 a: Semantic Water course detection

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136 ← ... → **134**

| ☖ | Ridge agents |
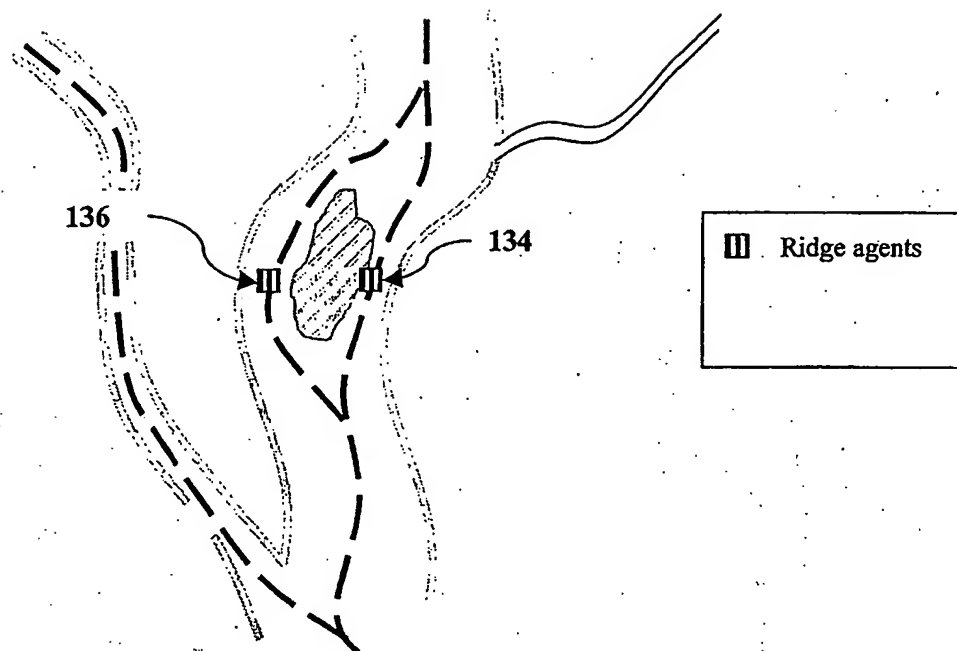
Figure 15 b: Semantic Water course detection

SUBSTITUTE SHEET (RULE 26)
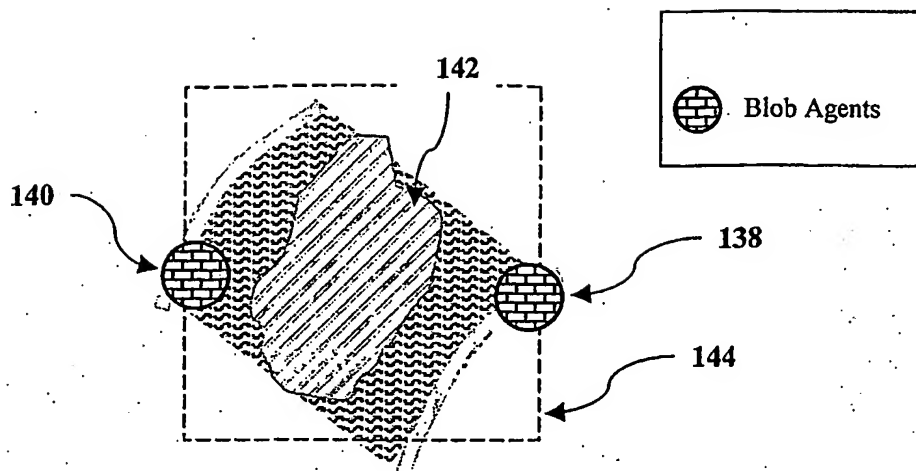
Figure 16 a: Higher scale blob detection

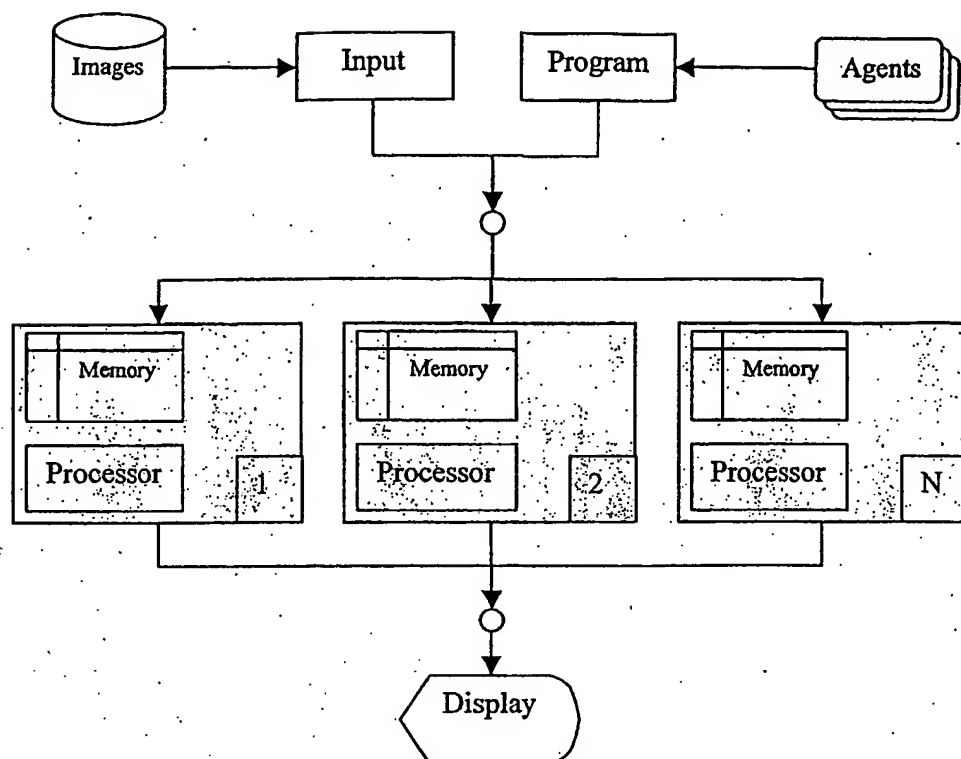SUBSTITUTE SHEET (RULE 26)
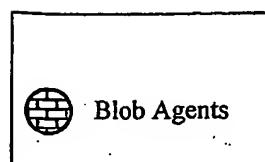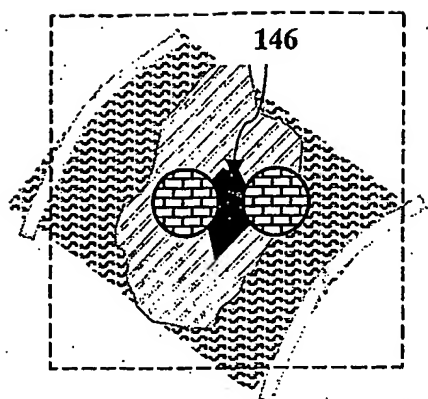
Figure 16 b: Higher scale blob detection

Figure 17: Apparatus with multiple processing nodes

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